

A Cost-Effective Approach to Producing Animated Infographics for Immunology Teaching[†]

Maria Bellei*, Paul Welch, Sally Pryor, and Natkunam Ketheesan
James Cook University, Townsville, QLD 4811, Australia

INTRODUCTION

Multimedia resources such as sound, video, still images, and animation are increasingly being used to enhance student engagement with educational content (1, 3, 6, 9), in particular, helping students construct their own understanding of concepts that are difficult to grasp (7). The use of computer animation in medical education has been described in several foundation subjects, including histology (1), cellular and molecular processes (3, 9), and immunology (6). However, the creation of animation is time-consuming and, hence, expensive when compared with static graphics (2). It also requires specialist skills, such as knowledge of animation concepts and animation software skills.

Immunology is considered a conceptually difficult subject and is further complicated by the use of special nomenclature and terminology. To master the subject, the learner must understand how multiple, abstract, interacting components fit together to explain different immunological concepts. The learner needs to be helped to construct their own knowledge by starting from their current level of understanding (7); the multiple, interacting components also place a high cognitive load on the student (8). To assist these processes, a lecturer in immunology could produce simple and accurate animation using readily available tools such as PowerPoint. However, this is time-consuming and the sophistication of the animation is restricted, limiting its communicative power. Alternatively, more complex animations are cost prohibitive, as they have to be outsourced to specialists.

Recognizing these challenges, we describe an alternative, low-cost process where we harnessed the need of design students for real-world projects in which their skills can be developed and assessed. The process involved multi-disciplinary collaboration between an immunology lecturer and a design lecturer. In this case, the two lecturers

were at the same university, but this is not essential as such collaborations could also be conducted via the Internet. The outcome was a series of three-minute videos explaining the immune response to an infectious agent. The students created them as part of the assessment for Still and Animated Typography for Creative Media, a subject in the Creative Arts Program at James Cook University, Australia. The videos were oriented to entry-level, tertiary immunology teaching and expressed as animated infographics with audio. The best works were selected and evaluated as supplemental resources in the immunology curriculum.

PROCEDURE

Storyboard design

The initial script was written by the immunologist, followed by the creation of a detailed storyboard in collaboration with the design lecturer. The storyboard included shot-by-shot specifications representing and correlating the graphics, text, animation, voiceover and sound effects involved. Their collaborative work included creating simplified visual codes to express complex concepts accurately (e.g., antigen epitopes of pathogens). It was a challenging process for both discipline experts involved. While the understanding of the complex nature of the immune system was a challenge for the design lecturer, the details required for the creation of a storyboard were problematic for the immunology lecturer. Therefore, the collaborative development process (Table 1) required a number of reviews prior to completion. For uniformity, static images of cells and molecules were adapted based on standard textbook illustrations (4).

Student production

Students were encouraged to create new and appropriate metaphors to illuminate immunological concepts whilst retaining specific, non-negotiable, basic process descriptions. Students worked in groups of four to six and developed metaphors such as warfare, gaming, and superheroes to represent the immune responses to infection. The artwork, voiceovers, and animation were assembled

*Corresponding author. Mailing address: James Cook University, Townsville, Queensland 4811. Phone: 4781-3666.

E-mail: maria.bellei@jcu.edu.au.

[†]Supplemental materials available at <http://asmscience.org/jmbe>

TABLE I.
Integrative development process.

Process	Design Specialist	Design & Immunology Specialists	Immunology Specialist
1		Discussion of developing quality learning tools	
2			Writing of scientific script
3		Development of visual language and specifications for text, animation and sound effects	
4	Create storyboard		
5	Supervision of student productions		
6		Review student videos and feedback	
7	Supervise student completion of videos		
8			Assessment and selection of videos

with Adobe After Effects software. Fifteen videos of varying quality, accuracy and originality were produced by the students over an eight-week period. The major challenges for design students included understanding immunology sufficiently to represent the content while paying attention to the non-negotiable parts of the storyboard. Additionally, during production, some revisions of the storyboard were made and the immunologist attended a screening of the initial videos and provided feedback. Following feedback to students, the videos were edited for accuracy prior to the completion of the final versions.

Selection of videos for teaching

The final videos were evaluated by a panel of post-graduate and undergraduate students taking courses in immunology using the following criteria: 1) accuracy, 2) motion graphics quality, 3) quality of design elements (visual impact, color, typography), and 4) innovative and creative representation of the 'story.' Two videos were selected for use in the immunology courses. The two selected videos were screened at the first face-to-face lecture on immunology to over 400 students enrolled in four different Year 1–3 undergraduate courses where immunology is a core component of the course.

Student surveys

Students were surveyed immediately after the lecture or within a day of watching the video. Approximately 70% (293/402) of students either 'agreed' or 'completely agreed' that the videos improved their understanding of the basic concepts in immunology while approximately 80% (327/402) of students either 'agreed' or 'completely agreed' that the videos made learning about the immune system more enjoyable. In addition, over 70% (287/396) of the students surveyed stated they would like the resources to be made available for reviewing of their course material (Fig. 1).

CONCLUSION

While the pedagogical approach and educational outcomes of the use of animation for education have been extensively reported, few studies describe the collaborative in-house development of such resources by academics and students (5). We describe here a unique, innovative and cost-effective method for producing digital media resources for tertiary level immunology teaching, where collaboration benefitted students of both disciplines (Fig. 2). To the authors' knowledge, the collaborative development process described here has not previously been reported in immunology. The result was the production of original, high-quality and effective supplemental teaching resources that were extensively reviewed and pedagogically engaging for all the students involved.

SUPPLEMENTAL MATERIALS

Appendix I: Screenshots of immunology animations with similar content

ACKNOWLEDGMENTS

The authors declare that there are no conflicts of interest.

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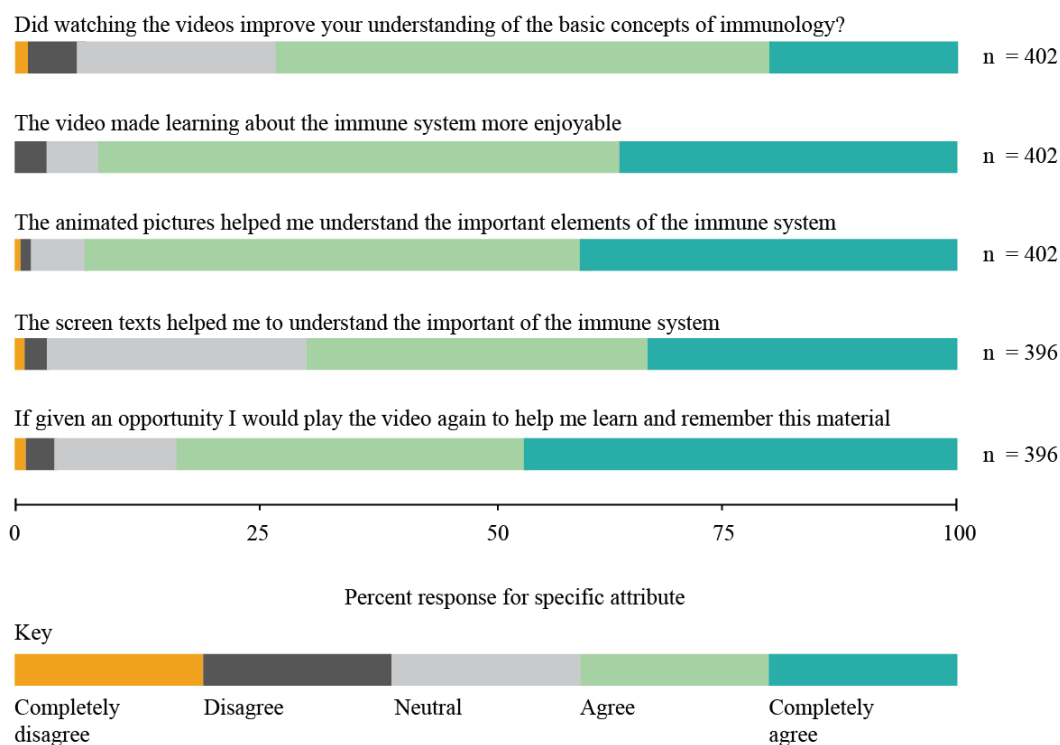


FIGURE 1. Student's responses to survey questions after watching the animated infographics during the immunology lecture ($n = 404$).

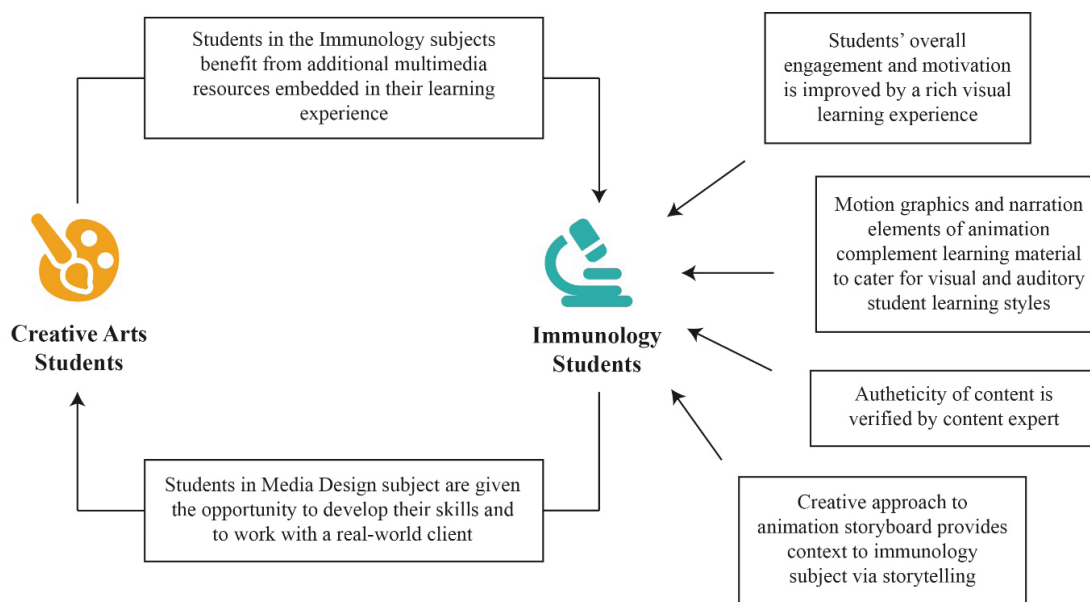


FIGURE 2. Producing multimedia resources for immunology teaching.

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